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Subject: **INFORMATION** GPS as a Primary Means of  
Navigation

Date: 2/11/97

From: Manager, Aircraft Engineering Division,  
AIR-100

Reply to  
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To: All Aircraft Certification Offices  
All Directorates

This memorandum is to notify you of the extension of the interim criteria defined in Notice 8110.60, *GPS as a Primary Means of Navigation for Oceanic/Remote Operations*. The Notice expired on December 4, 1996. While the criteria has been incorporated into a draft Advisory Circular, that AC is not expected to be released for FAA review until June. ACOs are requested to continue to use the criteria outlined in N 8110.60.

There are no changes to the requirements in N 8110.60. However, there have been several areas of confusion in the application of this Notice. The following paragraphs discuss these issues and elaborate on the initial criteria provided in the Notice.

*Follow-on Approvals in Different Make/Model Aircraft* Paragraph 6d states that follow-on approvals in a different make/model aircraft require an STC. An engineering review is necessary to establish compliance with the requirement that the loss of navigation is demonstrated to be improbable (paragraph 4f of N 8110.60). Note that this may require dual GPS antennas.

*Installations which do not require FDE/primary means* As a supplemental system, GPS may be used as one of two long-range navigators, where two are required for oceanic/remote operations. The other long-range navigator must be a sole-means navigation system (e.g., INS, Omega). Supplemental GPS may also be used as the only long-range navigation system for those oceanic/remote operations which require one long-range navigation system and one short-range navigation system (ref. AC 90-94, Section 1, paragraph 3b). Therefore, these operations do not require GPS equipment which complies with N 8110.60, and fault detection and exclusion (FDE) is not required. GPS equipment should satisfy the requirements described in TSO-C129(a), installed in accordance with AC 20-138 or AC 20-130A.

*Installation tests* As stated in paragraph 6b of the Notice, no additional tests above those specified in AC 20-138 and AC 20-130A are required. New installations of primary-means GPS equipment can be treated exactly as supplemental equipment, with the exception that the loss of the long-range navigation function must be demonstrated to be improbable (paragraph 4f of Notice 8110.60).

*Approval of previously installed GPS equipment* Some GPS manufacturers may demonstrate that their originally TSO'd articles are compliant with Notice 8110.60. These manufacturers should obtain a letter of design approval as described in paragraph 6a of Notice 8110.60. They may then send a copy of the letter to all customers who own the compliant equipment. Since the GPS equipment was previously installed and approved, and there are no modifications to the equipment, none of the qualification procedures of AC 20-138 or AC 20-130A need to be repeated. However, application must still be made for certification to evaluate compliance with the requirement that the loss of the long-range navigation function is improbable. The AFM(S) should also be updated per paragraph 6c of Notice 8110.60. In the case that a second GPS unit was not originally installed and approved, the second unit should be evaluated in accordance with AC 20-138 or AC 20-130A, as applicable.

*Upgrade of previously installed GPS equipment* Some GPS manufacturers may develop an upgrade to a TSO authorized article. This upgrade is considered a major design change as described in Title 14, Code of Federal Regulations, § 21.611(b). These manufacturers should obtain a letter of design approval, as described in paragraph 6a of Notice 8110.60. A copy of this letter should be included with the upgrade. Provided there are no other changes to the article's design, none of the qualification procedures of AC 20-138 or AC 20-130A need be repeated when the upgrade is installed. However, application must still be made for certification as the upgrade is a modification to the approved type design. The certification will evaluate compliance with the requirement that the loss of the long-range navigation function is improbable, and will update the AFM(S) per paragraph 6c of Notice 8110.60. In the case that a second GPS unit was not originally installed, the second unit should be evaluated in accordance with AC 20-138 or AC 20-130A, as applicable.

*FDE prediction capability* Paragraph 4g of Notice 8110.60 requires an FDE prediction capability. It is recommended that this capability allow the user to specify the maximum outage duration for the assessment of whether the operation can be conducted. While the Notice defines an algorithm for calculating the acceptable duration of an exclusion outage, additional criteria may be specified for specific operations. For example, the planned implementation of RNP-10 in the Pacific allows an outage duration of 34 minutes (based upon 20 nm/35 kts), even though the route width will be 50 nm (Order 8100.12, *Required Navigation Performance 10 (RNP-10) Operational Approval* paragraph 9(b)(3)).

*Achieved mask angle* Paragraph 5a of the Notice recommends that the GPS equipment be capable of using GPS satellites down to a mask angle of 0 degrees. It should be noted that the installed, achieved mask angle will frequently be higher due to installed antenna gain characteristics, signal blockage, and aircraft pitch during level flight. For these reasons, a mask angle of less than 2 degrees should not be used for the prediction capability. Installations which were previously approved using a lower mask angle do not need to be re-evaluated.

If you have any questions pertaining to the certification of GPS as a primary means of navigation, please contact Bruce DeCleene (202-267-8049).

/s/ James H. Williams for  
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